

## PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2000-023959

(43)Date of publication of application : 25.01.2000

(51)Int.Cl.

A61B 6/00  
H05G 1/44

(21)Application number : 10-198906

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(22)Date of filing : 14.07.1998

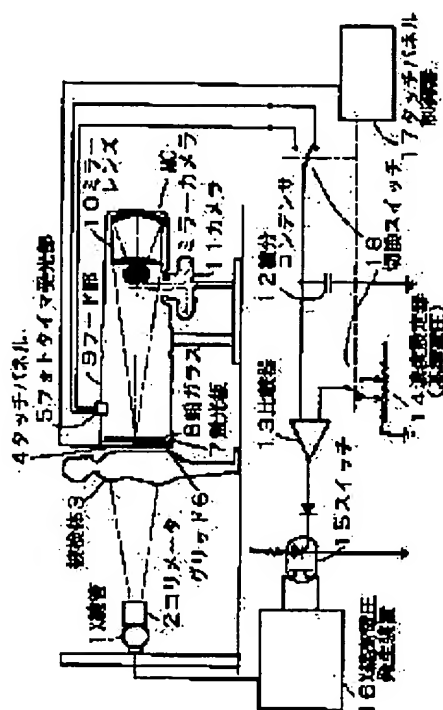
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## (54) RADIOGRAPHIC INSTRUMENT

## (57)Abstract:

**PROBLEM TO BE SOLVED:** To provide a radiographic instrument in which a plurality of phototimer photocell parts are automatically selected simply when a subject touches an imaging table while taking an imaging position.

**SOLUTION:** When a subject 3 touches a touch panel 4 while taking an imaging position, its signal urges the CPU of a touch panel controller 17 to compute X-Y coordinates to recognize a contact surface and to select an optimum phototimer photocell part from a plurality of phototimer photocell parts while automatically switching a selector switch 18 to start imaging. X-rays from an X-ray tube 1 are constricted by a collimator 2, are transmitted through the subject 3 as scattered rays are eliminated by a grid 6, and converted into an optical image by a fluoroscopic plate 7. Only a specific portion of light emitted through lead glass is captured by the phototimer photocell part 5 and its electric signals are integrated by an integrating capacitor 12, with its voltage and the reference voltage of a density setter 14 both inputted to a comparator 13; when both of the voltages are the same, a high-voltage shutoff signal is fed to a switch 15 to shut off the high voltage of an X-ray high voltage generator 16 to stop X-ray radiation, thus making it possible to take radiograph at the optimum density.



## LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

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CLAIMS

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[Claim(s)]

[Claim 1] In the X-rays equipment equipped with two or more phototimer light sensing portions which detect the transparency X-ray of analyte, and the phototimer control circuit which sends an X-ray cutoff signal to a high-voltage apparatus when the integral value of the electrical signal from a phototimer light sensing portion reaches reference voltage X-rays equipment characterized by having the means which can choose automatically the phototimer light sensing portion which prepared the touch panel which detects analyte posture in the X-ray input screen of a camera base, and was suitable for analyte posture from said two or more phototimer light sensing portions with the detecting signal of a touch panel.

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## DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] Especially this invention relates to the automatic exposure control which controls automatically the film density at the time of X photography the optimal about X-rays equipment.

[0002]

[Description of the Prior Art] The automatic-exposure-control equipment in X photography is used for almost all photofluorography, and is widely used also for the radiograph of a thorax, an abdomen, etc. Automatic-exposure-control equipment operates so that film density may be kept constant by controlling exposure time automatically, it changes into an electrical signal X dosage which penetrated analyte, when this quantity of electricity reaches constant value, an X-ray tends to be intercepted, and it is going to obtain the film density to wish.

[0003] The X-rays equipment of automatic exposure control using the mirror camera MC for X-ray photofluorography used for the mass screening of the conventional thorax is explained to drawing 6. The X-ray beam from X-ray tube 1 is irradiated by required visual field size with a collimator 2 at the rat tail analyte 3. The scattered radiation is removed by the grid 6, and incidence of the X-ray which penetrated analyte 3 is carried out to a fluorescent screen 7, and it is changed into a light figure by the transparency X-ray. The lead glass 8 for X-ray protection is formed behind that fluorescent screen 7, and the light figure of a fluorescent screen 7 carries out image formation to the film plane of a camera 11 with the mirror lens 10 in a hood 9 through this lead glass 8. On the other hand, two or more phototimer light sensing portions 5 are formed in the interior of the front upper part of the hood 9 of this mirror camera MC, and it is set as the device in which each phototimer light sensing portion 5 can receive the light of the specific region of the luminescence side of a fluorescent screen 7. Therefore, before taking a photograph, a way person chooses one of the phototimer light sensing portions 5 corresponding to the specific region suitable for a photography part manually on a control panel (change-over switch 18 of drawing 6).

[0004] Arrangement of the specific region suitable for the photography part in the thorax photography to drawing 7 was shown. In the object for thorax transverse planes, two light sensing portions 25 for thorax transverse planes of a part with the wide width of face of both lungs are used, and the light sensing portion 26 for thorax side faces of a longwise central part is used at the object for thorax side faces. During photography, the selected phototimer light sensing portion 5 catches the light of the specific region of a luminescence side, and detects it as a current signal proportional to X dosage. This current signal is inputted into a phototimer control section (control section which consists of a change-over switch 18, an integrating capacitor 12, a concentration setting calibration master 14, a comparator 13, and a switch 15), and it integrates with it to the integrating capacitor 12 of this phototimer control section, and it is inputted into a comparator 13 as a voltage signal. On the other hand, a comparator 13 outputs an X-ray cutoff signal to a switch 15, when the voltage signal and reference voltage with which it integrated from the concentration setter 14 with reference to the reference voltage which determines the concentration of a film are compared and both are in agreement. In response to this signal, the X-ray high-voltage transformer assembly 16 intercepts the high voltage, and stops the X-ray emission from X-ray tube 1.

[0005]

[Problem(s) to be Solved by the Invention] Although the conventional X-rays equipment is constituted as mentioned above, since it corresponds to various posture of analyte, two or more light sensing portions are prepared, the way person has switched the phototimer light sensing portion 5 manually on the control panel before photography, before various activities of ID registration of analyte, a photography electrical potential difference, a setup of a photography current, etc. taking a photograph, there is, and there is a problem of mistaking a change-over of the phototimer light sensing portion 5. When there is much subject, such as a thorax mass screening, in order to prevent the change-over mistake of a light sensing portion, when the light sensing portion for side faces is chosen, in photography of a thorax transverse plane and a thorax side face, approaches, such as sounding a buzzer, are taken, but there is a problem that a way person has to switch manually in that case.

[0006] This invention aims at offering the X-rays equipment which can do a change-over automatically, even if it is made in view of such a situation and a way person does not switch the phot timer light sensing portion 5 manually.

[0007]

[Means for Solving the Problem] In order to attain the above-mentioned purpose, the X-rays equipment of this invention In the X-rays equipment equipped with two or more phototimer light sensing portions which detect the transparency X-ray of analyte, and the phototimer control circuit which sends an X-ray cutoff signal to a high-voltage apparatus when the integral value of the electrical signal from a phototimer light sensing portion reaches reference voltage The touch panel which detects analyte posture is prepared in the X-ray input screen of a camera base, and it is characterized by having the means which can choose automatically the phototimer light sensing portion which was suitable for analyte posture from said two or more phototimer light sensing portions with the detecting signal of a touch panel.

[0008] The X-rays equipment of this invention is constituted as mentioned above, a touch panel detects the field of the part touched by attaching a touch panel in the image reception area of a camera base, and since the phototimer light sensing portion suitable for the part is chosen automatically, the need that a way person switches manually is lost.

[0009]

[Embodiment of the Invention] One example of the X-rays equipment of this invention is explained referring to drawing 1. This equipment consists of X-ray tube 1, the touch panel 4 attached in the front face of an input of the mirror camera MC for photofluorography, and this mirror camera MC, the phototimer light sensing portion 5 which takes up the light of the X-ray image on a fluorescent screen, a phototimer

control section which performs automatic exposure control, a touch panel controller 17, and an X-ray high-voltage transformer assembly 16, and the phototimer control section consists of a circuit changing switch 18, the integrating capacitor 12, a concentration setter 14, a comparator 13, and a switch 15.

[0010] The touch panel 4 currently used for this invention is attached in the front face of the image reception area in which the X-ray image which penetrated the analyte 3 of the hood 9 of the mirror camera MC for photofluorography carries out incidence. This touch panel 4 is a thing using the touch location detection method of an ultrasonic surface-acoustic-waves method, is the glass panel plate whose light transmittance is about about 90%, and is stuck, set and used for a CRT monitor, the display side of a LCD monitor, etc. Here, although it does not need to be transparent, since the lighting range of the phototimer light sensing portion 5 is displayed on the X-ray incidence side front face of the hood 9 of a mirror camera MC, this is observable.

[0011] As this touch panel 4 is shown in drawing 2, the surface acoustic waves with which each slit of propagation and a reflective array reflected the reflective array top as surface acoustic waves, and the supersonic wave generated from the ultrasonic radiator (the X-radiator 19, Y-radiator 21) in the corner of a panel spread to all the corners of a panel, and spread the panel top are collected by the reflective array of the opposite side, and return to a carrier pendulum (X-carrier pendulum 20, Y-carrier pendulum 22). In the surface acoustic waves which pass along the minimum distance a then, and the surface acoustic waves which pass along the longest distance c, if time difference was produced in time of concentration and the analyte section has touched in the B point in the time difference, the surface acoustic waves which pass along b will be absorbed by the analyte section, and will be recognized by the carrier pendulum as return and location detection data as a reduced wave. The amount of the surface acoustic waves absorbed by the analyte section can also be recognized as Z direction data. Drawing 3 shows a time change of the dispatch signal 23 and input signal 24 on the strength. CPU of the touch panel controller 17 changes this time location into X coordinate and Y coordinate.

[0012] Next, actuation of the X-rays equipment of this invention is explained. First, analyte 3 is located on a camera base and pushes the body against a touch panel 4 by the posture to photo. Although drawing 4 shows the page [ of the image reception area in 30 / 27th ] touch part 29 at least for a thorax forward surface part and drawing 5 shows the touch part 28 to the image reception area 27 in the case of the thorax side-face part 31, it is shown that these drawing 4 and drawing 5 need selection of the lighting part of the phototimer light sensing portion 5 in order to obtain the optimal film density in transverse-plane photography and side-face photography of a thorax.

[0013] As for a touch panel 4, delivery, and the X coordinate and Y coordinate of a touch part (28 of 29 or drawing 5 of drawing 4) of the analyte are first read by CPU of the touch panel controller 17 in CPU of the touch panel controller 17 in the touch signal. The phototimer light sensing portion 5 which recognizes this coordinate pattern and has [ from ] the optimal lighting range among two or more phototimer light sensing portions 5 is chosen. Drawing 1 shows the case where it has two phototimer light sensing portions, the object for thorax transverse planes, and the object for thorax side faces, 5. The change-over switch 18 for the selection is switched by the signal of the touch panel controller 17. A change-over switch 18 switches a change-over of the phototimer light sensing portion 5, and the reference voltage of the concentration setter 14 which determines the film density suitable for it. Actuation of a change-over switch 18 is performed automatically, and there is no need that a way person sets up manually.

[0014] Roentgenography can begin in this condition. The actuation is the same as conventional equipment, and is irradiated by the visual field size which needs the X-ray beam from X-ray tube 1 at a collimator 2 at a rat tail and analyte 3. The scattered radiation is removed by the grid 6, and incidence of the X-ray which penetrated analyte 3 is carried out to a fluorescent screen 7, and it is changed into a light figure by the transparency X-ray. The lead glass 8 for X-ray protection is formed behind that fluorescent screen 7, and the light figure of a fluorescent screen 7 carries out image formation to the film plane of a camera 11 with the mirror lens 10 in a hood 9 through this lead glass 8. On the other hand, two or more phototimer light sensing portions 5 are formed in the interior of the front upper part of this mirror camera hood 9, and it is set as the device in which each phototimer light sensing portion 5 can receive the light of the specific region of the luminescence side of a fluorescent screen 7.

[0015] Therefore, before taking a photograph, it is automatically chosen with the touch panel controller 17 by the signal from a touch panel 4 (change-over switch 18 of drawing 1), and during photography, one of the phototimer light sensing portions 5 corresponding to the specific region suitable for a photography part catches the light of the specific region of a luminescence side, and it detects the selected phototimer light sensing portion 5 as a current signal proportional to X dosage. It integrates with this current signal to the integrating capacitor 12 of a phototimer control section, and it is inputted into a comparator 13 as a voltage signal. On the other hand, a comparator 13 outputs an X-ray cutoff signal to a switch 15, when the voltage signal and reference voltage with which it integrated from the concentration setter 14 with reference to the reference voltage which determines film density are compared and both are in agreement. In response to this signal, the X-ray high-voltage transformer assembly 16 intercepts the high voltage, and stops the X-ray emission from X-ray tube 1.

[0016]

[Effect of the Invention] The X-rays equipment of this invention is constituted as mentioned above, by choosing automatically the phototimer light sensing portion 5 suitable for the posture of analyte by the signal of a touch panel 4, can cancel the complicated activity before a way person's photography, and can obtain the X-ray photograph film of optimum density by X-ray automatic exposure control.

[0017]

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DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] It is drawing showing one example of the X-rays equipment of this invention.

[Drawing 2] It is drawing showing the principle of a touch panel.

[Drawing 3] It is drawing showing the relation between the input signal of a touch panel, and time amount.

[Drawing 4] It is drawing showing the condition like the thorax forward surface part of a touch panel.

[Drawing 5] It is drawing showing the condition of the thorax side-face part of a touch panel.

[Drawing 6] It is drawing showing the conventional X-rays equipment.

[Drawing 7] It is drawing showing the division light sensing portion of an image reception area.

[Description of Notations]

- 1 -- X-ray tube 2 -- Collimator
- 3 -- Analyte 4 -- Touch panel
- 5 -- Phototimer light sensing portion 6 -- Grid
- 7 -- Fluorescent screen 8 -- Lead glass
- 9 -- Hood 10 -- Mirror lens
- 11 -- Camera 12 -- Integrating capacitor
- 13 -- Comparator 14 -- Concentration setter (reference voltage)
- 15 -- Switch 16 -- X-ray high-voltage transformer assembly
- 17 -- Touch panel controller 18 -- Change-over switch
- 19 -- X-radiator 20 -- X-carrier pendulum
- 21 -- Y-radiator 22 -- Y-carrier pendulum
- 23 -- Dispatch signal 24 -- Input signal
- 25 -- Light sensing portion for thorax transverse planes 26 -- Light sensing portion for thorax side faces
- 27 -- Image reception area 28 29 -- Touch part
- 30 -- About a thorax forward surface part 31 -- Thorax side-face part
- MC -- Mirror camera

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## 【特許請求の範囲】

【請求項1】被検体の透過X線を検出する複数のフォトタイマ受光部と、フォトタイマ受光部からの電気信号の積分値が基準電圧に達したときX線遮断信号を高電圧装置に送るフォトタイマ制御回路とを備えたX線撮影装置において、撮影台のX線入力面に被検体体位を検出するタッチパネルを設け、タッチパネルの検出信号により前記複数のフォトタイマ受光部から被検体体位に適したフォトタイマ受光部を自動的に選択することができる手段を備えることを特徴とするX線撮影装置。

## 【発明の詳細な説明】

## 【0001】

【発明の属する技術分野】本発明は、X線撮影装置に関し、特にX線写真撮影時のフィルム濃度を自動的に最適に制御する自動露出制御に関する。

## 【0002】

【従来の技術】X線写真撮影における自動露出制御装置はほとんどの間接撮影に用いられ、胸部、腹部などの直接撮影にも広く利用されている。自動露出制御装置は、撮影時間を自動制御することによりフィルム濃度を一定に保つように作動するもので、被検体を透過したX線量を電気信号に変換し、この電流量が一定値に達したときX線を遮断し、希望するフィルム濃度を得ようとするものである。

【0003】図6に従来の胸部の集団検診に用いるX線間接撮影用のミラーカメラMCを用いた自動露出制御のX線撮影装置について説明する。X線管1からのX線ビームがコリメータ2で必要な視野サイズに絞られ被検体3に照射される。被検体3を透過したX線はグリッド6で散乱線が除去され蛍光板7に入射し、透過X線により光像に変換される。その蛍光板7の後ろにX線防護のための鉛ガラス8が設けられ、この鉛ガラス8を通してフード部9内のミラーレンズ10により蛍光板7の光像がカメラ11のフィルム面に結像する。一方、このミラーカメラMCのフード部9の前方上方内部に複数のフォトタイマ受光部5が設けられており、蛍光板7の発光面の特定領域の光をそれぞれのフォトタイマ受光部5が受光できる機構に設定されている。従って撮影する前に、撮影部位に適した特定領域に対応したフォトタイマ受光部5の一つを、制御パネル上で術者が手動で選択（図6の40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 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3

から構成され、フォトタイマ制御部は切換えスイッチ18と積分コンデンサ12と濃度設定器14と比較器13とスイッチ15から構成されている。

【0010】本発明に使用されているタッチパネル4は、間接撮影用ミラーカメラMCのフード部9の、被検体3を透過したX線像の入射する受像面の前面に取り付けられている。このタッチパネル4は超音波表面弾性波方式のタッチ位置検出方式を利用したもので、光透過率がほぼ90%程度のガラス製のパネルプレートで、CRTモニタやLCDモニタのディスプレイ面等に貼りあわせて使われる。ここでは透明である必要はないが、ミラーカメラMCのフード部9のX線入射側表面にフォトタイマ受光部5の採光範囲が表示されているので、これを観察することができる。

【0011】このタッチパネル4は図2に示すように、パネルの隅にある超音波発振子(X-発振子19、Y-発振子21)から発生する超音波が、表面弾性波として反射アレイ上を伝わり、反射アレイの各スリットにより反射され、パネルの隅々まで行き渡り、パネル上を行き渡った表面弾性波は、対辺の反射アレイにより集約され、受振子(X-受振子20、Y-受振子22)に戻る。その時最短距離aを通る表面弾性波と最長距離cを通る表面弾性波では、到達時間に時間差を生じ、その時間差の中でB点で被検体部がタッチしていると、bを通る表面弾性波は被検体部に吸収され、弱まった波形として受振子に戻り、位置検出データとして認識される。その被検体部に吸収される表面弾性波の量を、Z方向データとして認識することもできる。図3はその発信信号23と受信信号24の時間的な強度変化を示す。この時間的な位置をX座標、Y座標にタッチパネル制御器17のCPUが変換する。

【0012】次に、本発明のX線撮影装置の操作について説明する。まず、被検体3が撮影台に立ち、撮影する体位でタッチパネル4に体を押しつける。図4は、胸部正面部位30の場合の受像面27面へのタッチ部分29を示し、図5は、胸部側面部位31の場合の受像面27面へのタッチ部分28を示しているが、これら図4、図5は胸部の正面撮影と側面撮影において、最適フィルム濃度を得るためにフォトタイマ受光部5の採光部分の選択が必要であることを示している。

【0013】まずタッチパネル4はそのタッチ信号をタッチパネル制御器17のCPUに送り、その被検体のタッチ部分(図4の29または図5の28)のX座標とY座標が、タッチパネル制御器17のCPUにて読み取られる。この座標パターンを認識して複数のフォトタイマ受光部5のうちから、最適な採光範囲を持つフォトタイマ受光部5を選択する。図1では、胸部正面用と胸部側面用の2つのフォトタイマ受光部5が備えられた場合を示す。その選択のための切換えスイッチ18が、タッチパネル制御器17の信号で切り換えられる。切換えスイッチ

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18はフォトタイマ受光部5の切換と、それに適したフィルム濃度を決める濃度設定器14の基準電圧を切り換える。切換えスイッチ18の動作は自動的に行なわれ、術者が手動で設定する必要が無い。

【0014】この状態でX線撮影が始められる。その動作は従来の装置と同じで、X線管1からのX線ビームがコリメータ2で必要な視野サイズに絞られ、被検体3に照射される。被検体3を透過したX線はグリッド6で散乱線が除去され蛍光板7に入射し、透過X線により光像に変換される。その蛍光板7の後ろにX線防護のための鉛ガラス8が設けられ、この鉛ガラス8を通してフード部9内のミラーレンズ10により蛍光板7の光像がカメラ11のフィルム面に結像する。一方、このミラーカメラフード部9の前方上方内部に複数のフォトタイマ受光部5が設けられており、蛍光板7の発光面の特定領域の光をそれぞれのフォトタイマ受光部5が受光できる機構に設定されている。

【0015】従って撮影する前に、撮影部位に適した特定領域に対応したフォトタイマ受光部5の一つが、自動的にタッチパネル4からの信号でタッチパネル制御器17で選択されており(図1の切換えスイッチ18)、撮影中、選択されたフォトタイマ受光部5は、発光面の特定領域の光を捉え、X線量に比例した電流信号として検出する。この電流信号はフォトタイマ制御部の積分コンデンサ12に積分され電圧信号として比較器13に入力される。一方、比較器13は濃度設定器14からフィルム濃度を決定する基準電圧を参照して、積分された電圧信号と基準電圧を比較し両者が一致したときにスイッチ15にX線遮断信号を出力する。X線高電圧発生装置16はこの信号を受けて、高電圧を遮断し、X線管1からのX線放射を停止させる。

【0016】

【発明の効果】本発明のX線撮影装置は上記のように構成されており、被検体の体位に適したフォトタイマ受光部5を、タッチパネル4の信号で自動的に選択することによって、術者の撮影前の煩雑な作業が解消でき、X線自動露出制御により最適濃度のX線写真フィルムを得ることができる。

【0017】

40 【図面の簡単な説明】

【図1】 本発明のX線撮影装置の一実施例を示す図である。

【図2】 タッチパネルの原理を示す図である。

【図3】 タッチパネルの受信信号と時間との関係を示す図である。

【図4】 タッチパネルの胸部正面部位の状態を示す図である。

【図5】 タッチパネルの胸部側面部位の状態を示す図である。

50 【図6】 従来のX線撮影装置を示す図である。



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【図7】 受像面の分割受光部を示す図である。

【符号の説明】

1…X線管  
3…被検体  
5…フォトタイマ受光部  
7…蛍光板  
9…フード部  
11…カメラ  
デンサ  
13…比較器  
器(基準電圧)  
15…スイッチ  
圧発生装置

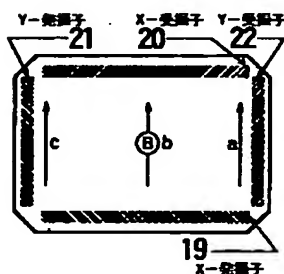
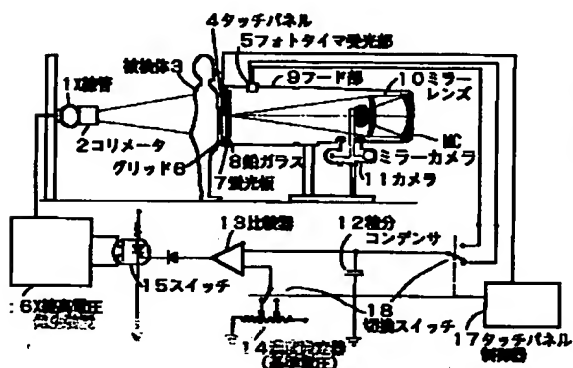
2…コリメータ  
4…タッチパネ  
ル  
6…グリッド  
8…鉛ガラス  
10…ミラーレン  
12…積分コン  
14…濃度設定  
16…X線高電

17…タッチパネル制御器  
19…X-発振子  
21…Y-発振子  
23…発信信号  
25…胸部正面用受光部  
用受光部  
27…受像面  
タッチ部分  
30…胸部正面部位  
部位  
MC…ミラーカメラ

18…切換スイ  
20…X-受振  
22…Y-受振  
24…受信信号  
26…胸部側面  
28、29…タ  
31…胸部側面

【図1】

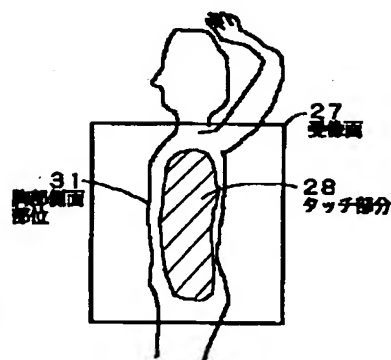
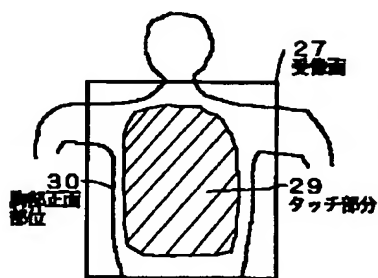
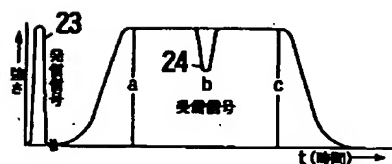
【図2】



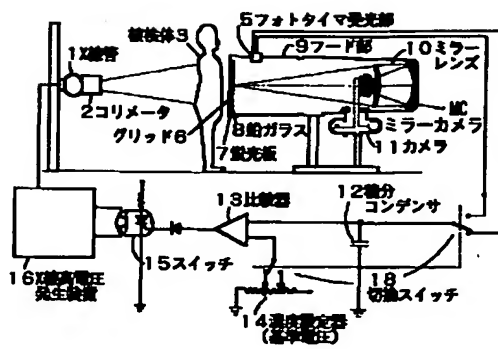
【図3】

【図4】

【図5】



【図6】



【図7】

